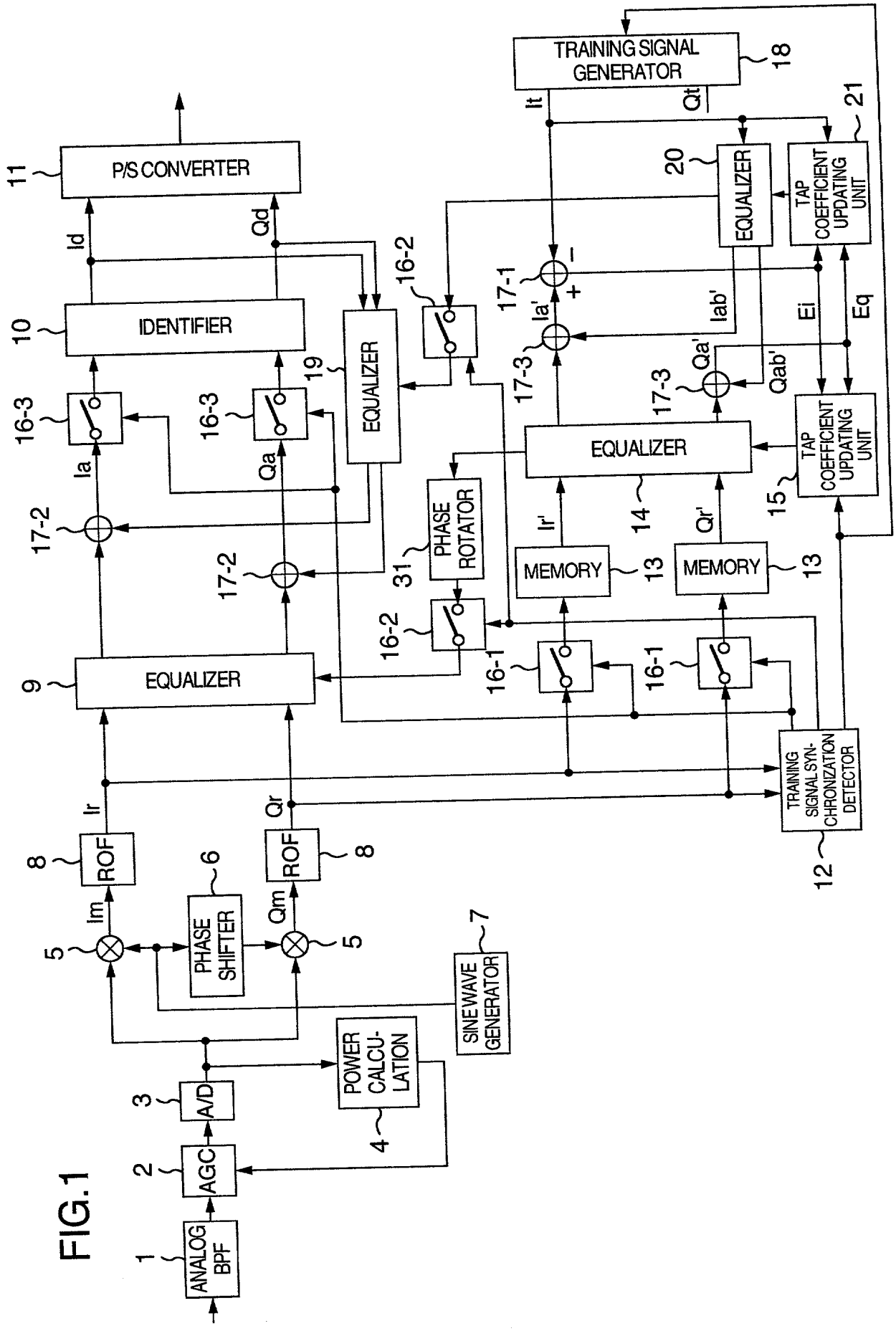

ANALOG BPF
AGC
A/D
POWER CALCU-LATION
SINE WAVE GENERATOR
PHASE SHIFTER
ROF
ROF
EQUALIZER
IDENTIFIER
P/S CONVERTER
EQUALIZER
PHASE ROTATOR
MEMORY
MEMORY
EQUALIZER
EQUALIZER
TRAINING SIGNAL GENERATOR
TAP COEFFICIENT UPDATING UNIT
TAP COEFFICIENT UPDATING UNIT
TRAINING SIGNAL SYN-CHRONIZATION DETECTOR
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16-1
16-2
16-3
17-1
17-2
17-3
18
19
20
21
31
Id
Qd
Ia
Qa
Ir
Qr
Im
Qm
It
Qt
Ia'
Iab'
Qa'
Qab'
Ir'
Qr'
Ei
Eq

FIG.1

FIG.2

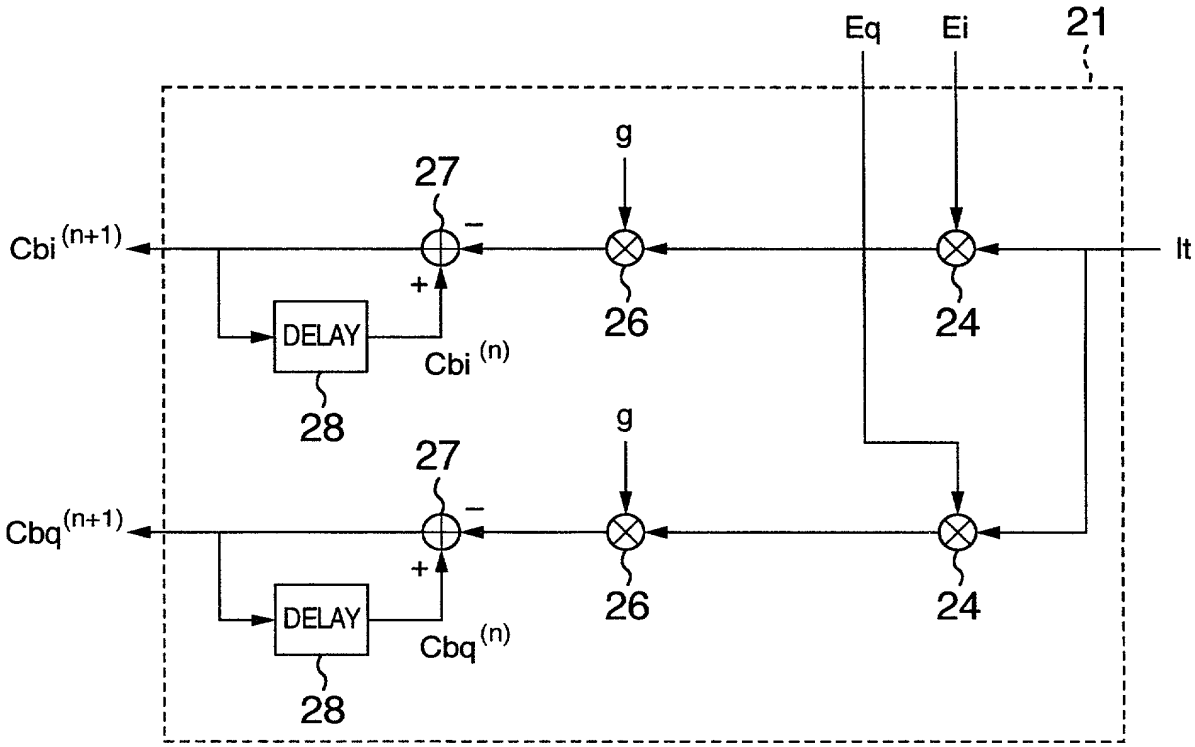

Eq
Ei
21
g
27
Cbi (n+1)
It
DELAY
Cbi (n)
26
24
28
g
27
Cbq (n+1)
DELAY
Cbq (n)
26
24
28

FIG.3

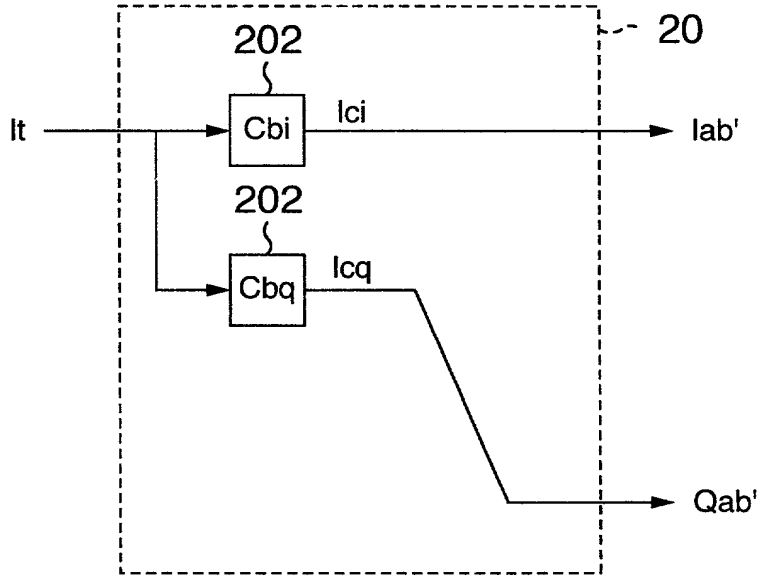

20
202
It
Cbi
Ici
Iab'
202
Cbq
Icq
Qab'

FIG.4

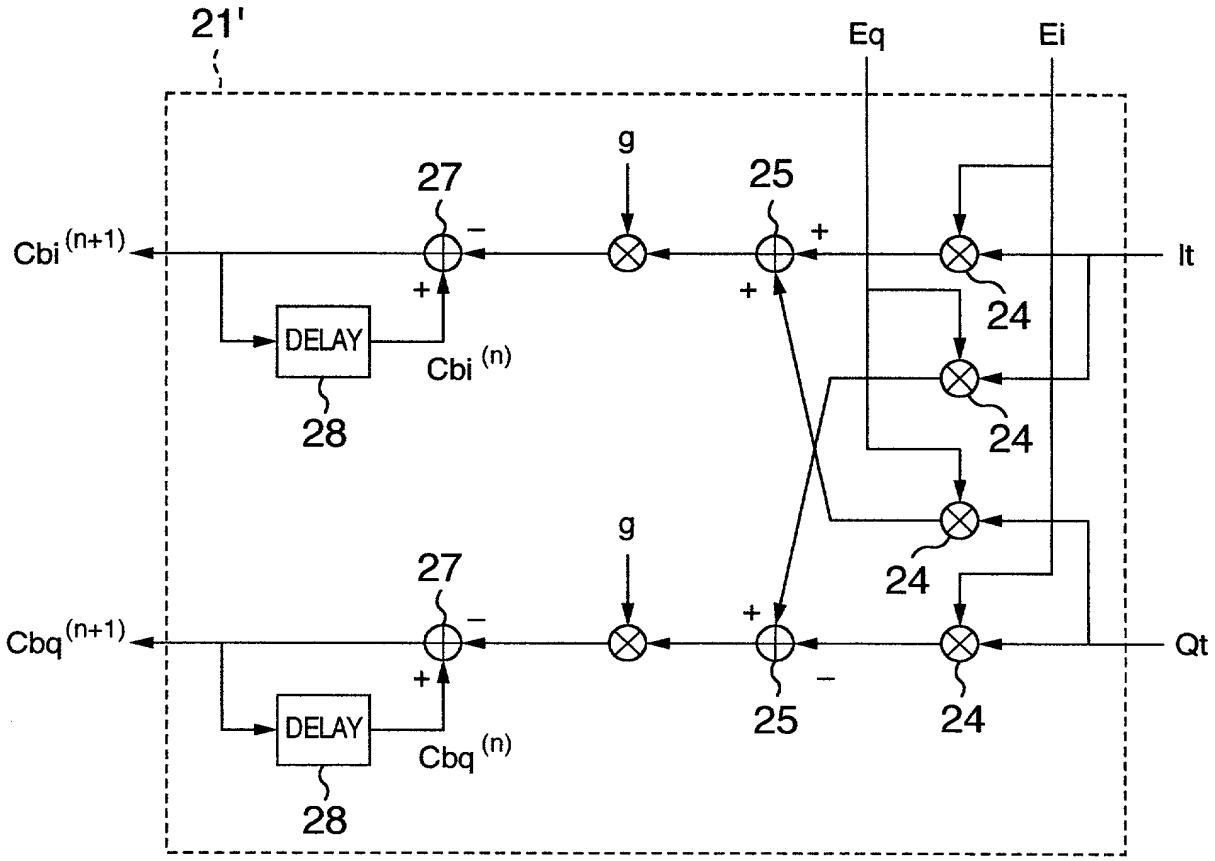

21'
Eq
Ei
g
27
25
Cbi (n+1)
It
DELAY
Cbi (n)
28
24
24
24
g
27
Cbq (n+1)
Qt
DELAY
Cbq (n)
28
25
24

FIG.5

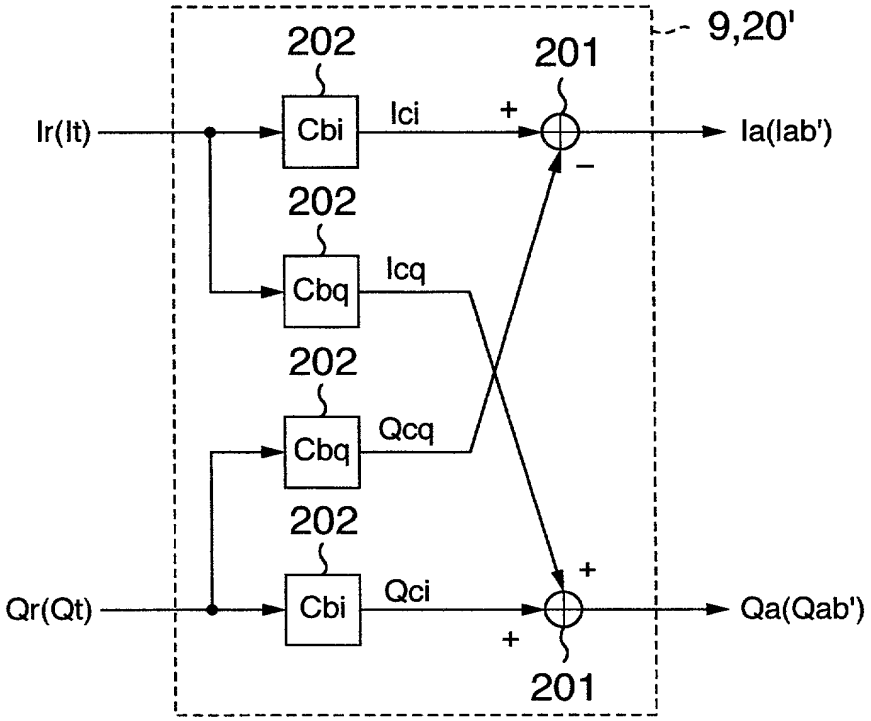

9,20'
202
201
Ir(It)
Cbi
Ici
+
Ia(Iab')
−
202
Cbq
Icq
202
Cbq
Qcq
202
Cbi
Qci
+
Qr(Qt)
Qa(Qab')
+
201

FIG.6

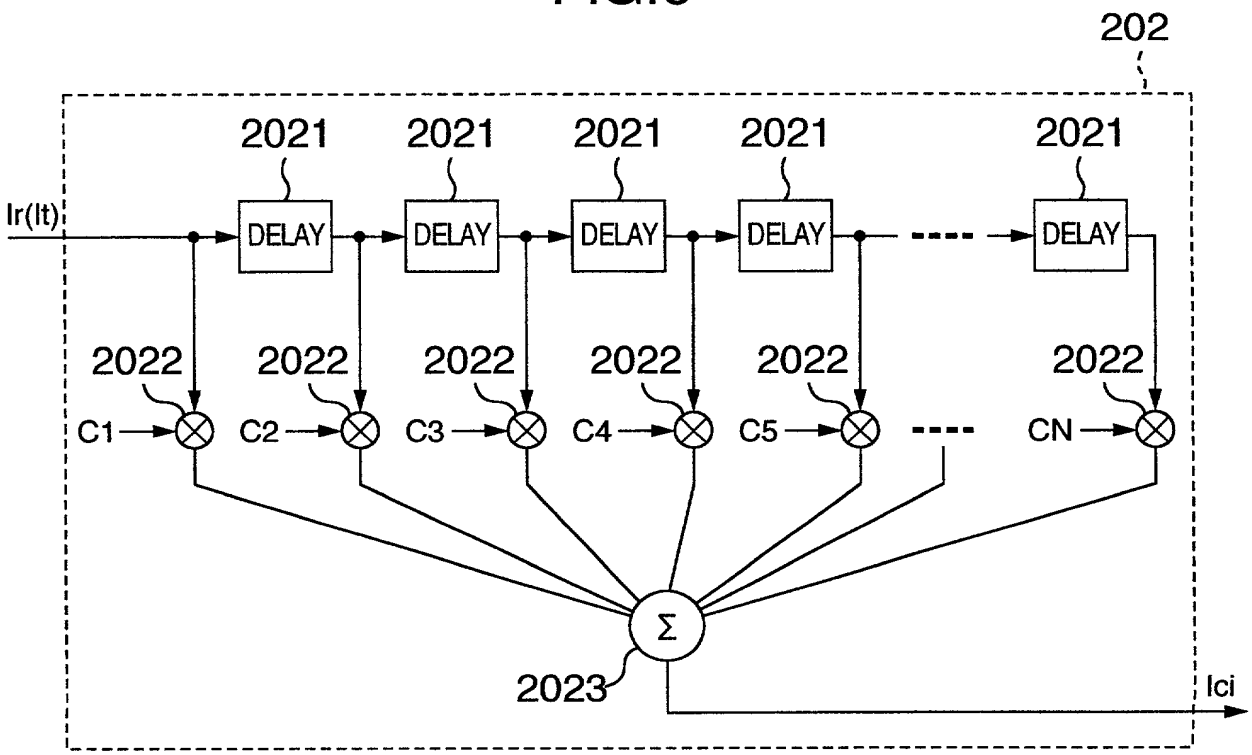

202
2021
2021
2021
2021
2021
Ir(It)
DELAY
DELAY
DELAY
DELAY
DELAY
2022
2022
2022
2022
2022
2022
C1
C2
C3
C4
C5
CN
Σ
2023
Ici

FIG.7

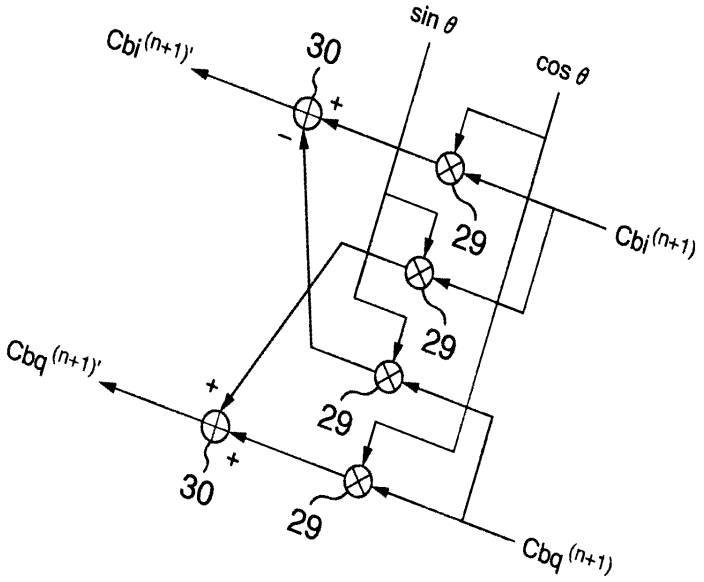

sin θ
cos θ
Cbi (n+1)'
30
+
−
29
Cbi (n+1)
29
29
Cbq (n+1)'
+
29
+
30
29
Cbq (n+1)

FIG.8

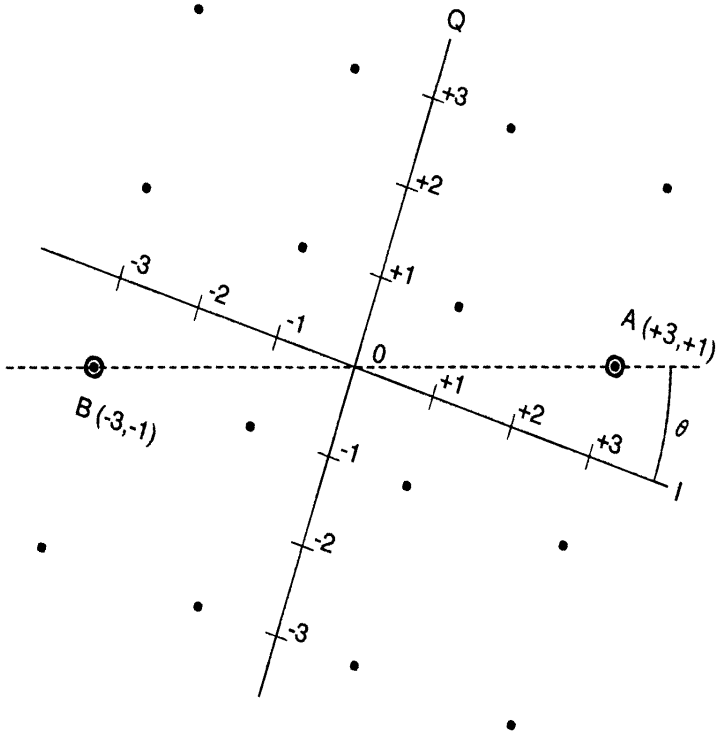
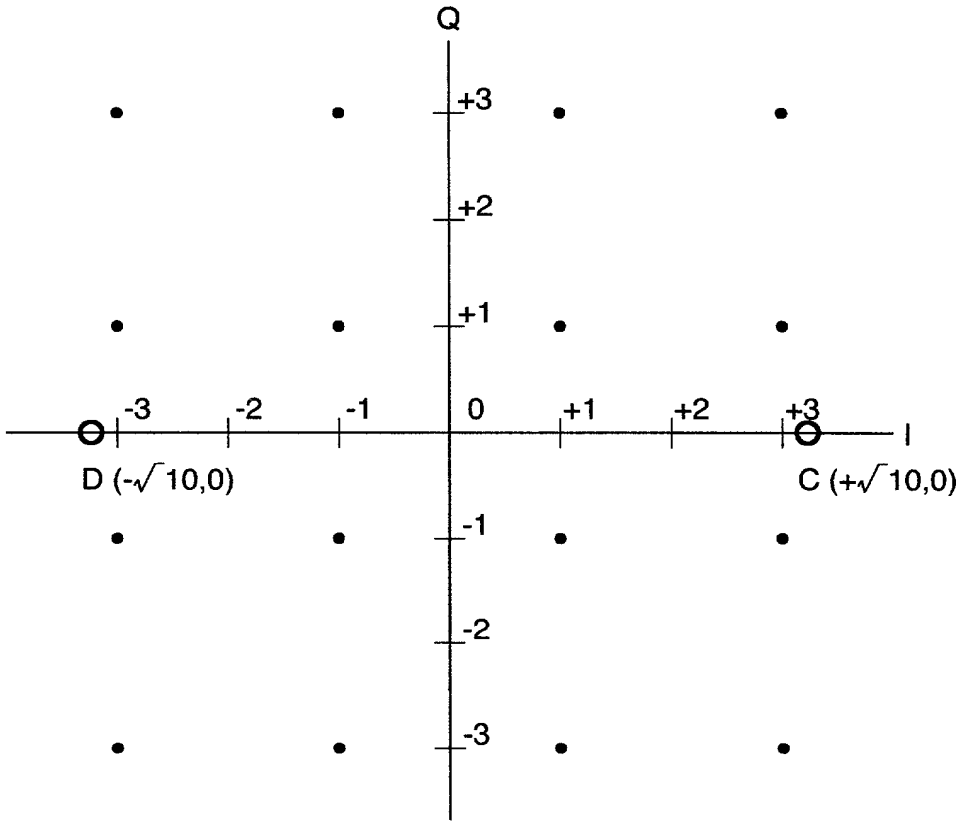

Q
+3
+2
+1
-3
-2
-1
0
A (+3,+1)
B (-3,-1)
+1
+2
+3
θ
I
-1
-2
-3

FIG.9



O SIGNAL POINT OF TRAINING SIGNAL

FIG.10

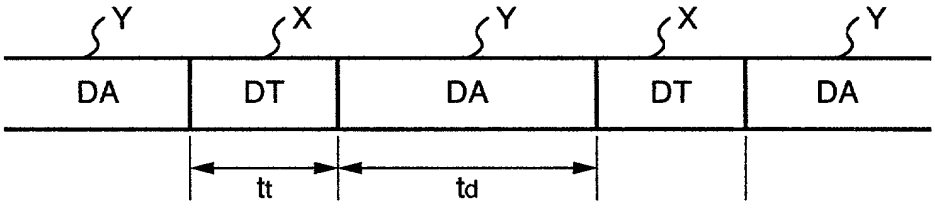


FIG.11
PRIOR ART

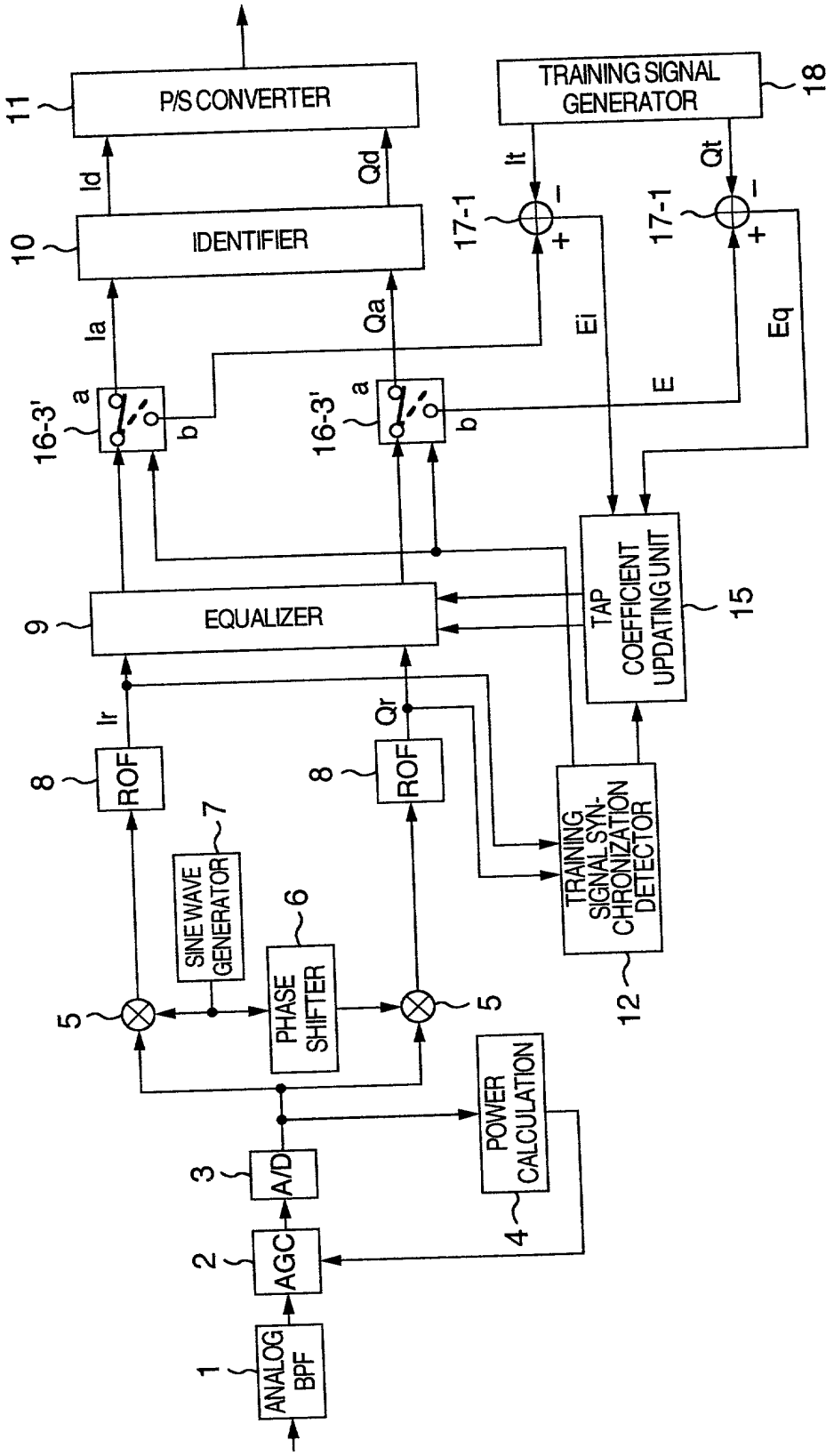


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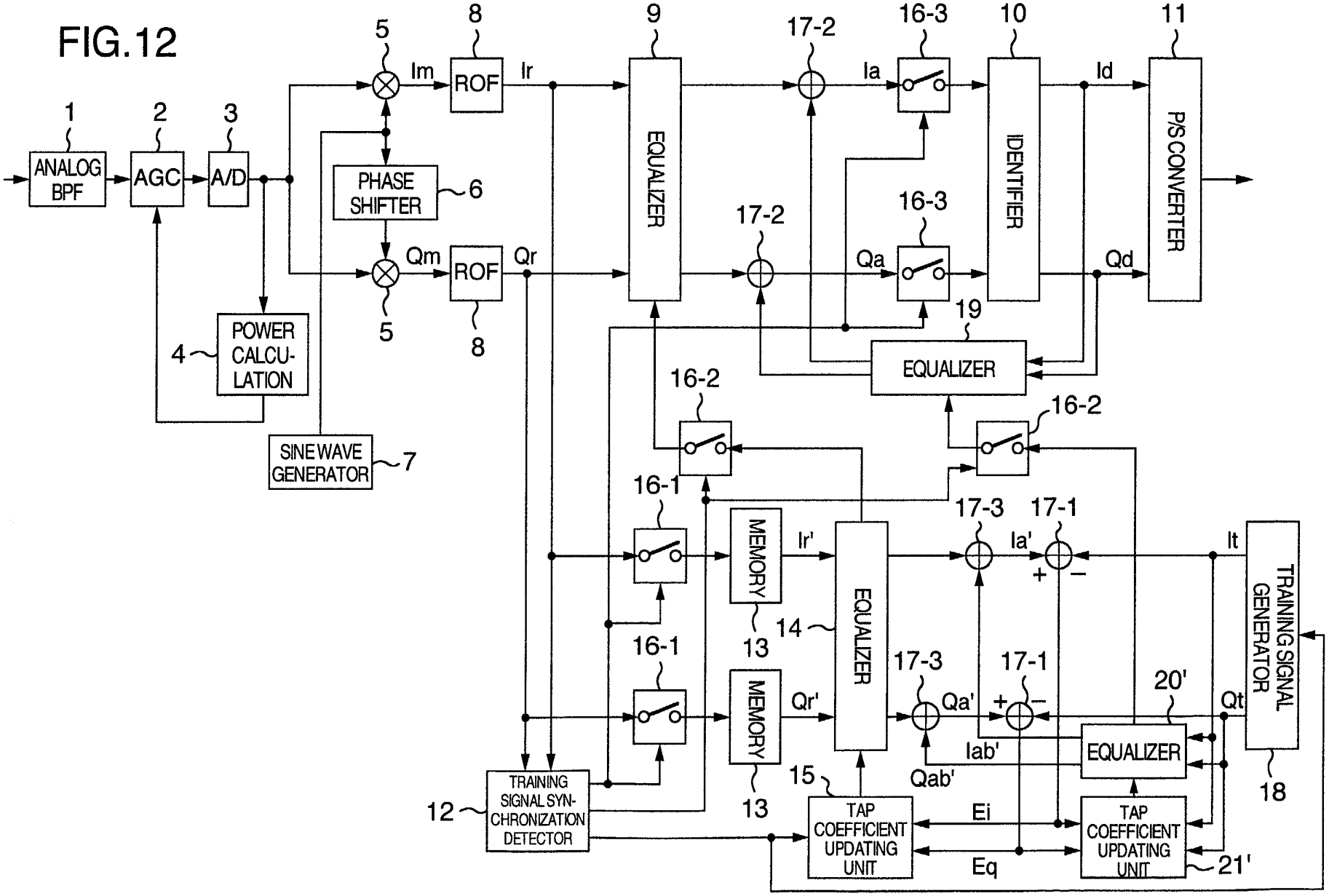
FIG.12



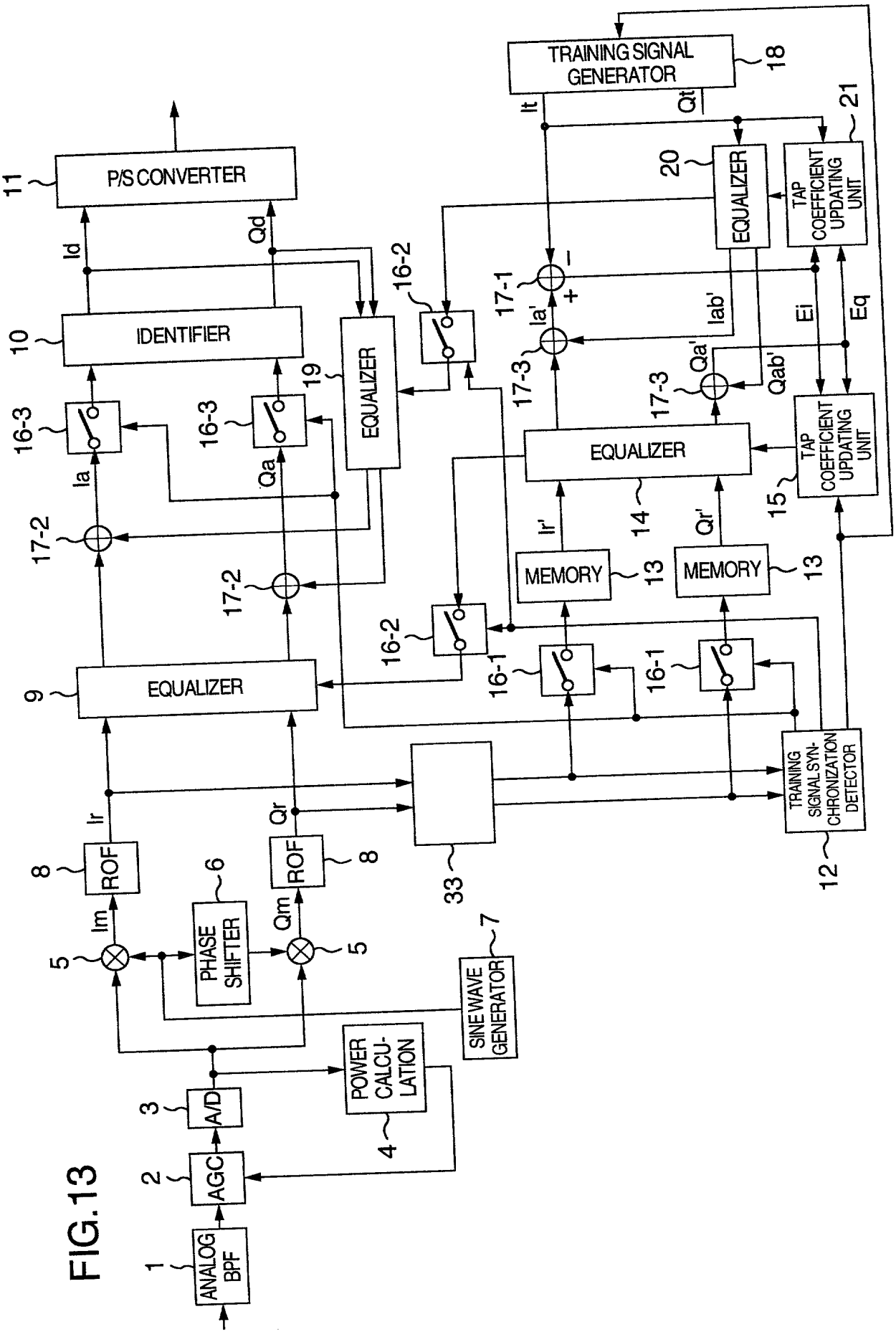

ANALOG BPF
1
AGC
2
A/D
3
POWER CALCU-LATION
4
SINE WAVE GENERATOR
7
PHASE SHIFTER
6
ROF
8
ROF
8
Im
Qm
Ir
Qr
5
5
EQUALIZER
9
P/S CONVERTER
11
IDENTIFIER
10
Id
Qd
Ia
Qa
16-3
16-3
16-2
EQUALIZER
19
17-2
17-2
16-2
16-1
16-1
MEMORY
13
MEMORY
13
Ir'
Qr'
EQUALIZER
14
TAP COEFFICIENT UPDATING UNIT
15
17-3
17-3
Qa'
Qab'
17-1
Ia'
Iab'
Ei
Eq
EQUALIZER
20
TAP COEFFICIENT UPDATING UNIT
21
TRAINING SIGNAL GENERATOR
18
It
Qt
TRAINING SIGNAL SYN-CHRONIZATION DETECTOR
12
33

FIG. 13

FIG.14

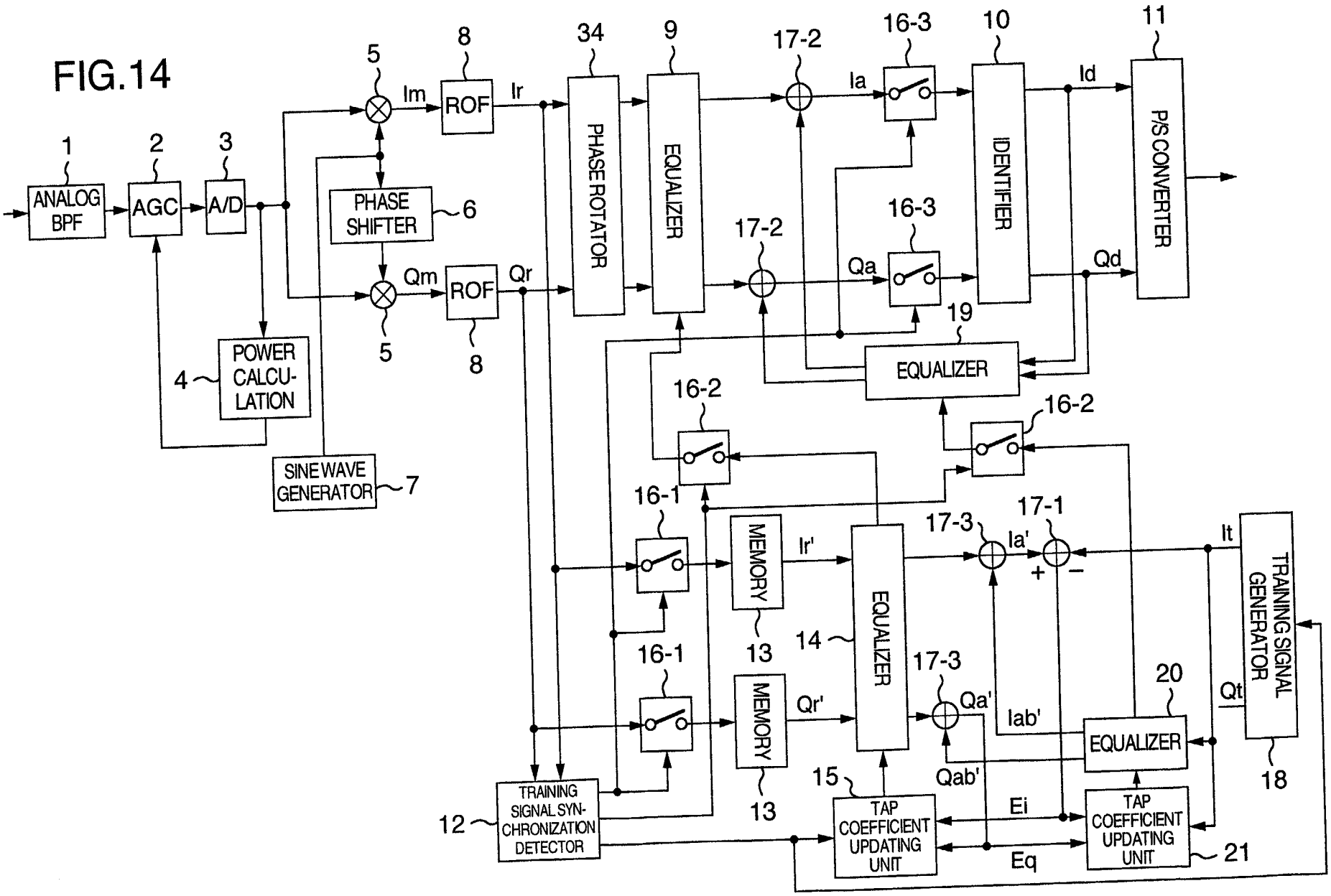

1
2
3
ANALOG BPF
AGC
A/D
5
Im
8
ROF
Ir
34
PHASE ROTATOR
9
EQUALIZER
17-2
16-3
Ia
10
IDENTIFIER
Id
11
P/S CONVERTER
PHASE SHIFTER
6
Qm
ROF
Qr
5
8
17-2
16-3
Qa
Qd
19
EQUALIZER
4
POWER CALCU-LATION
SINE WAVE GENERATOR
7
16-2
16-2
16-1
MEMORY
Ir'
17-3
17-1
Ia'
It
TRAINING SIGNAL GENERATOR
14
EQUALIZER
16-1
MEMORY
13
Qr'
17-3
Qa'
Iab'
20
EQUALIZER
Qt
18
15
TRAINING SIGNAL SYN-CHRONIZATION DETECTOR
12
TAP COEFFICIENT UPDATING UNIT
Ei
Eq
Qab'
TAP COEFFICIENT UPDATING UNIT
21
13

FIG.15

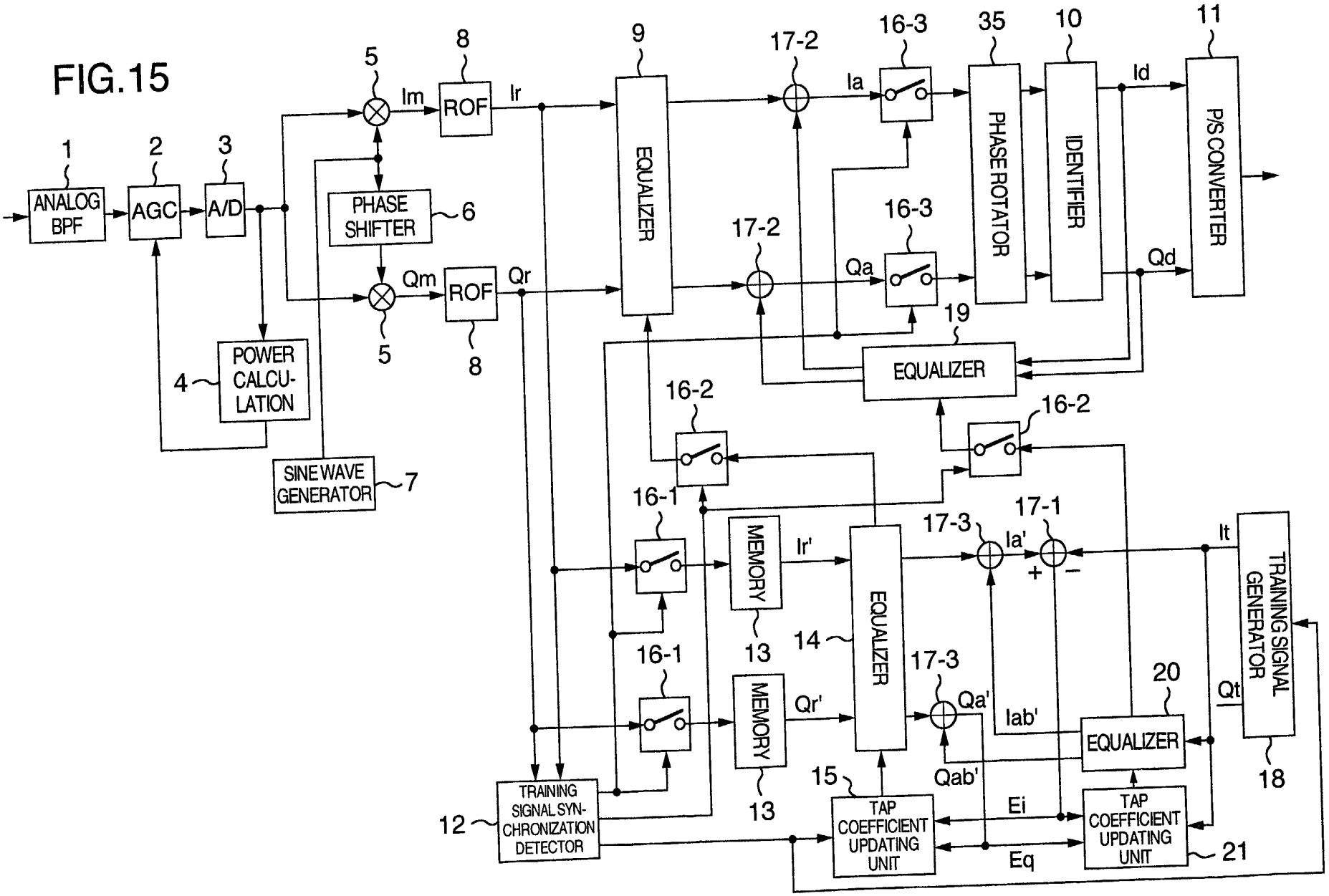

1
ANALOG BPF
2
AGC
3
A/D
4
POWER CALCU-LATION
5
Im
5
Qm
6
PHASE SHIFTER
7
SINE WAVE GENERATOR
8
ROF
8
ROF
Ir
Qr
9
EQUALIZER
17-2
17-2
16-3
Ia
16-3
Qa
35
PHASE ROTATOR
10
IDENTIFIER
11
P/S CONVERTER
Id
Qd
19
EQUALIZER
16-2
16-2
16-1
16-1
MEMORY
Ir'
13
MEMORY
Qr'
13
14
EQUALIZER
17-3
Ia'
17-1
+
−
17-3
Qa'
17-3
Iab'
Qab'
20
EQUALIZER
It
Qt
TRAINING SIGNAL GENERATOR
18
12
TRAINING SIGNAL SYN-CHRONIZATION DETECTOR
15
TAP COEFFICIENT UPDATING UNIT
Ei
Eq
TAP COEFFICIENT UPDATING UNIT
21

FIG.16

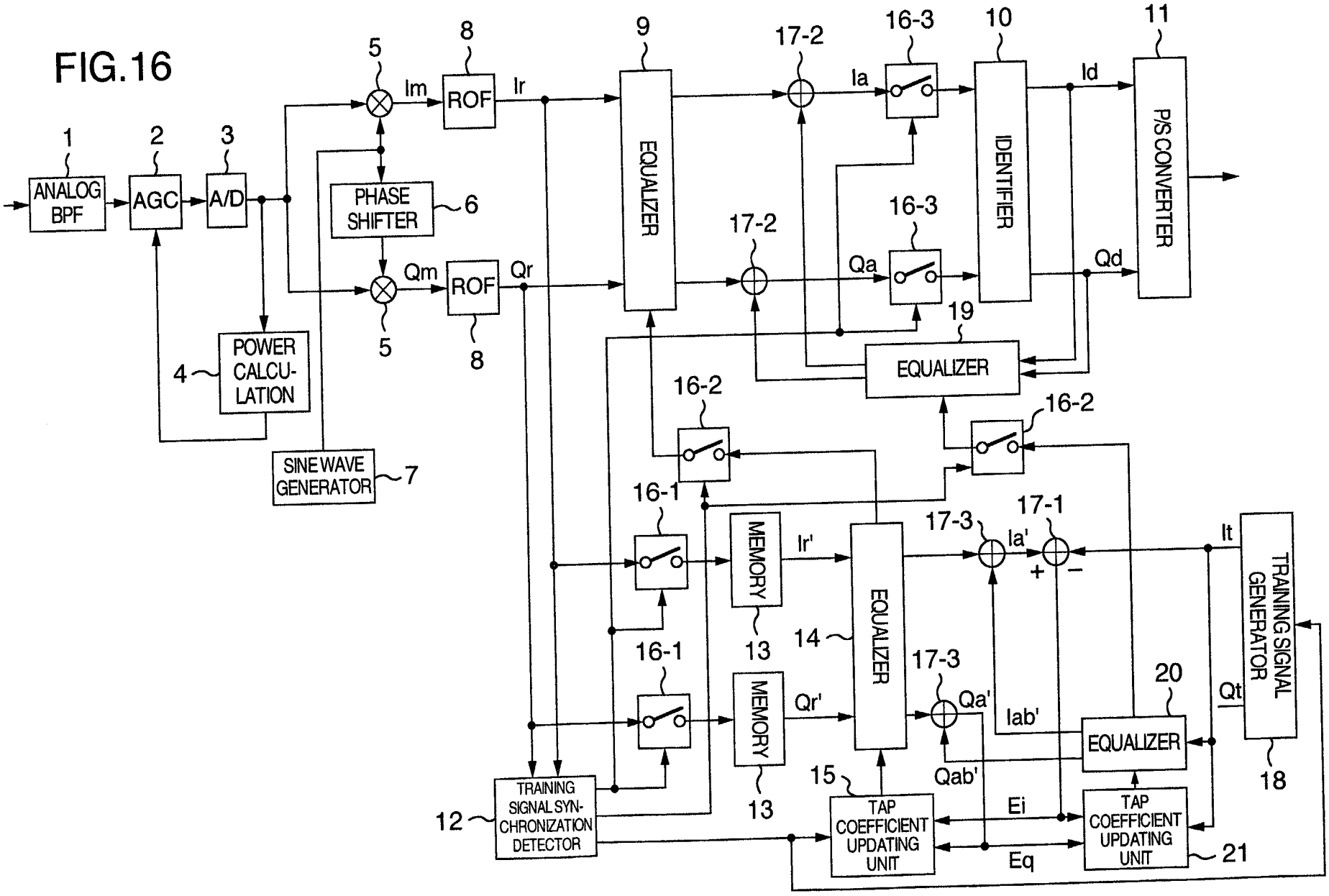

1
ANALOG BPF
2
AGC
3
A/D
4
POWER CALCU-LATION
5
Im
5
Qm
6
PHASE SHIFTER
7
SINE WAVE GENERATOR
8
ROF
8
ROF
Ir
Qr
9
EQUALIZER
10
IDENTIFIER
11
P/S CONVERTER
16-3
16-3
16-2
16-2
16-1
16-1
17-2
17-2
17-3
17-3
17-1
Ia
Qa
Id
Qd
19
EQUALIZER
Ir'
Qr'
MEMORY
MEMORY
13
13
14
EQUALIZER
15
TAP COEFFICIENT UPDATING UNIT
Ei
Eq
Ia'
Iab'
Qa'
Qab'
It
Qt
20
EQUALIZER
TAP COEFFICIENT UPDATING UNIT
21
TRAINING SIGNAL GENERATOR
18
12
TRAINING SIGNAL SYN-CHRONIZATION DETECTOR

FIG.17

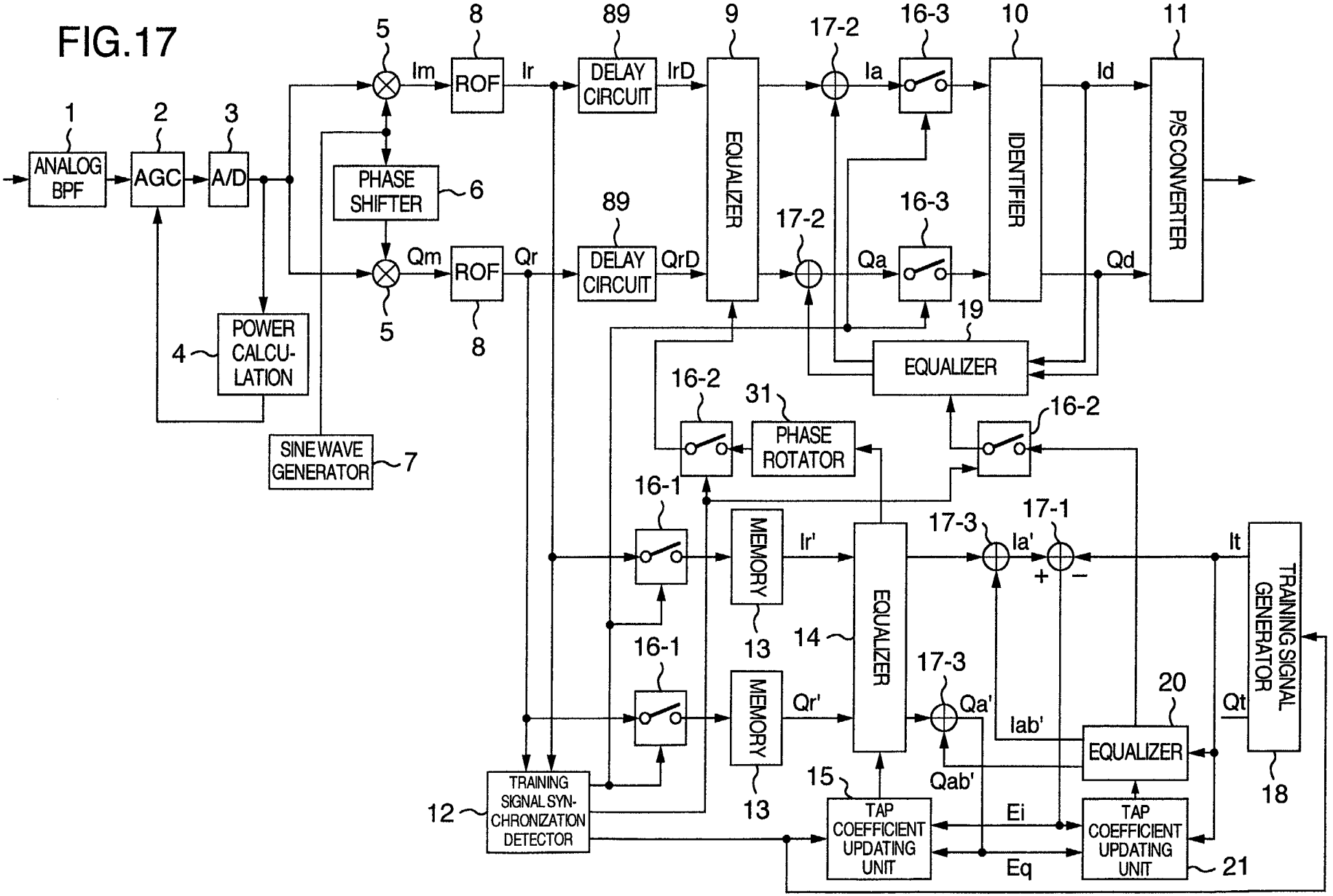

ANALOG BPF
AGC
A/D
POWER CALCU-LATION
SINE WAVE GENERATOR
PHASE SHIFTER
ROF
DELAY CIRCUIT
EQUALIZER
IDENTIFIER
P/S CONVERTER
PHASE ROTATOR
MEMORY
TRAINING SIGNAL SYN-CHRONIZATION DETECTOR
TAP COEFFICIENT UPDATING UNIT
TRAINING SIGNAL GENERATOR
Im
Ir
IrD
Ia
Id
Qm
Qr
QrD
Qa
Qd
Ir'
Qr'
Ia'
Qa'
Iab'
Qab'
It
Qt
Ei
Eq

FIG.18

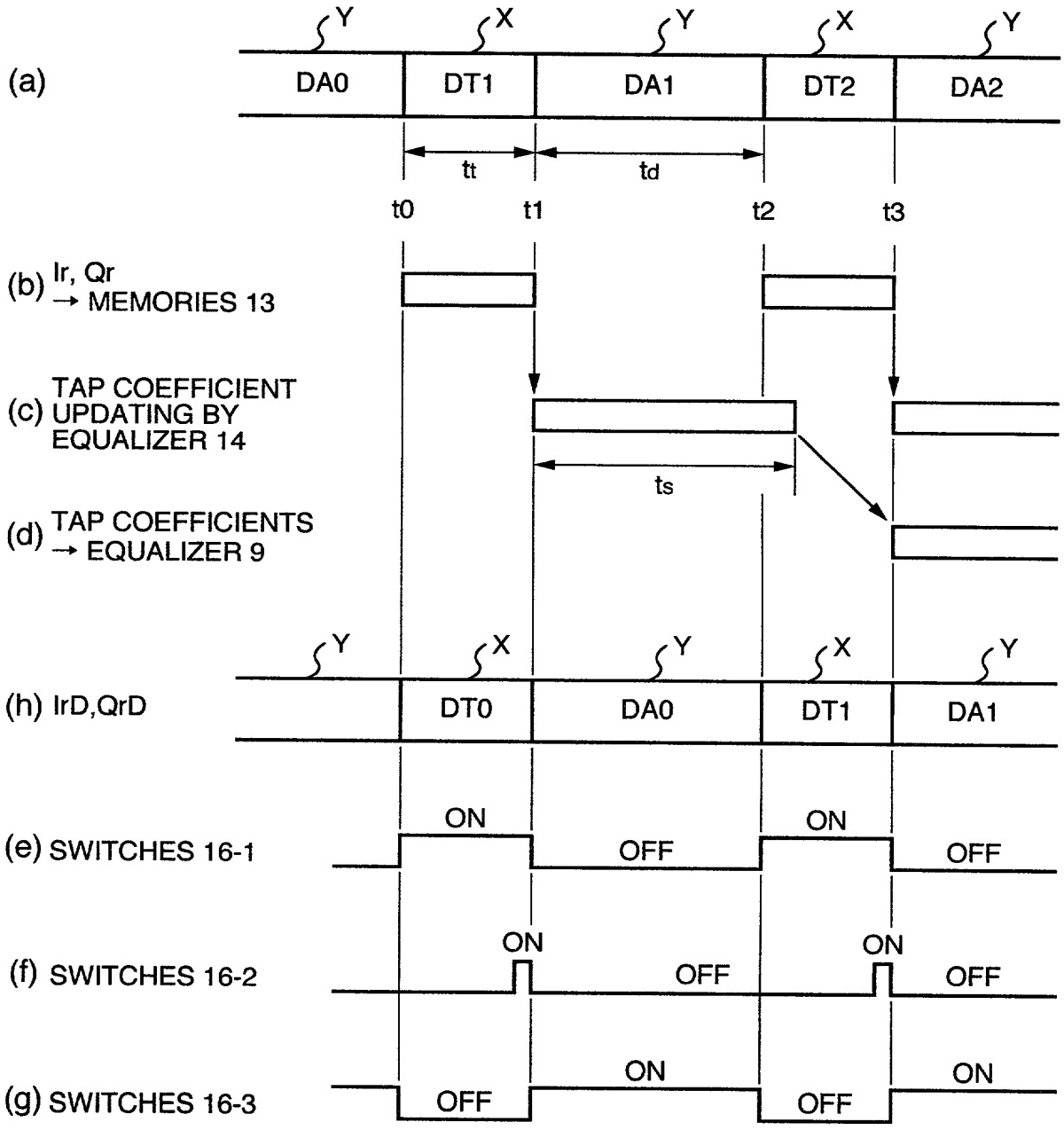

(a)
Y
X
Y
X
Y
DA0
DT1
DA1
DT2
DA2
tt
td
t0
t1
t2
t3
(b) Ir, Qr → MEMORIES 13
(c) TAP COEFFICIENT UPDATING BY EQUALIZER 14
ts
(d) TAP COEFFICIENTS → EQUALIZER 9
(h) IrD,QrD
DT0
DA0
DT1
DA1
(e) SWITCHES 16-1
ON
OFF
(f) SWITCHES 16-2
(g) SWITCHES 16-3

FIG.19

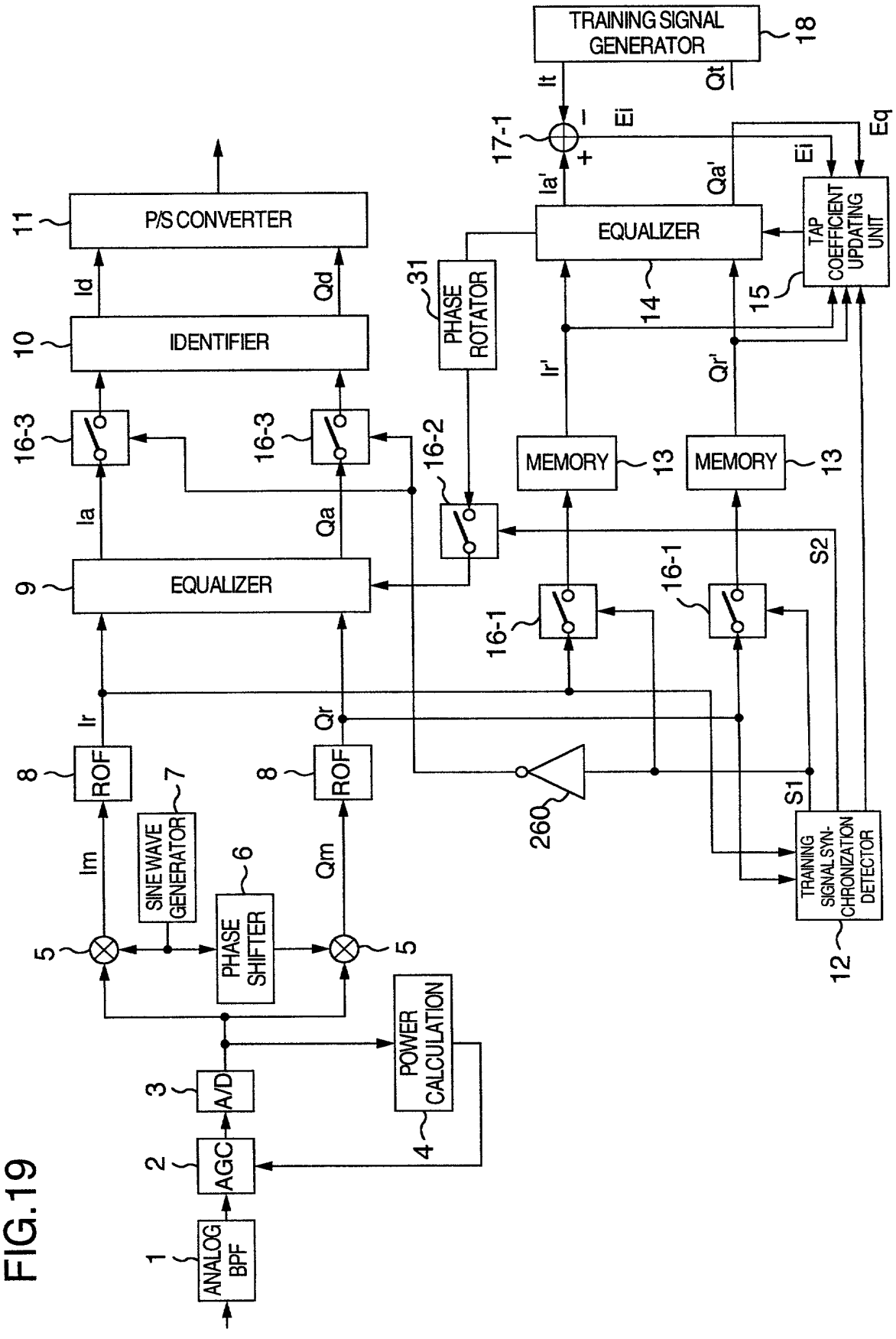

TRAINING SIGNAL GENERATOR
18
It
Qt
17-1
Ei
Eq
Ei
Ia'
Qa'
EQUALIZER
TAP COEFFICIENT UPDATING UNIT
14
15
31
PHASE ROTATOR
Ir'
Qr'
MEMORY
13
MEMORY
13
16-2
16-1
16-1
S2
S1
260
11
P/S CONVERTER
Id
Qd
10
IDENTIFIER
16-3
16-3
Ia
Qa
9
EQUALIZER
Ir
Qr
8
ROF
8
ROF
7
SINE WAVE GENERATOR
6
PHASE SHIFTER
Im
Qm
5
5
POWER CALCULATION
4
3
A/D
2
AGC
1
ANALOG BPF
TRAINING SIGNAL SYN-CHRONIZATION DETECTOR
12

FIG.20

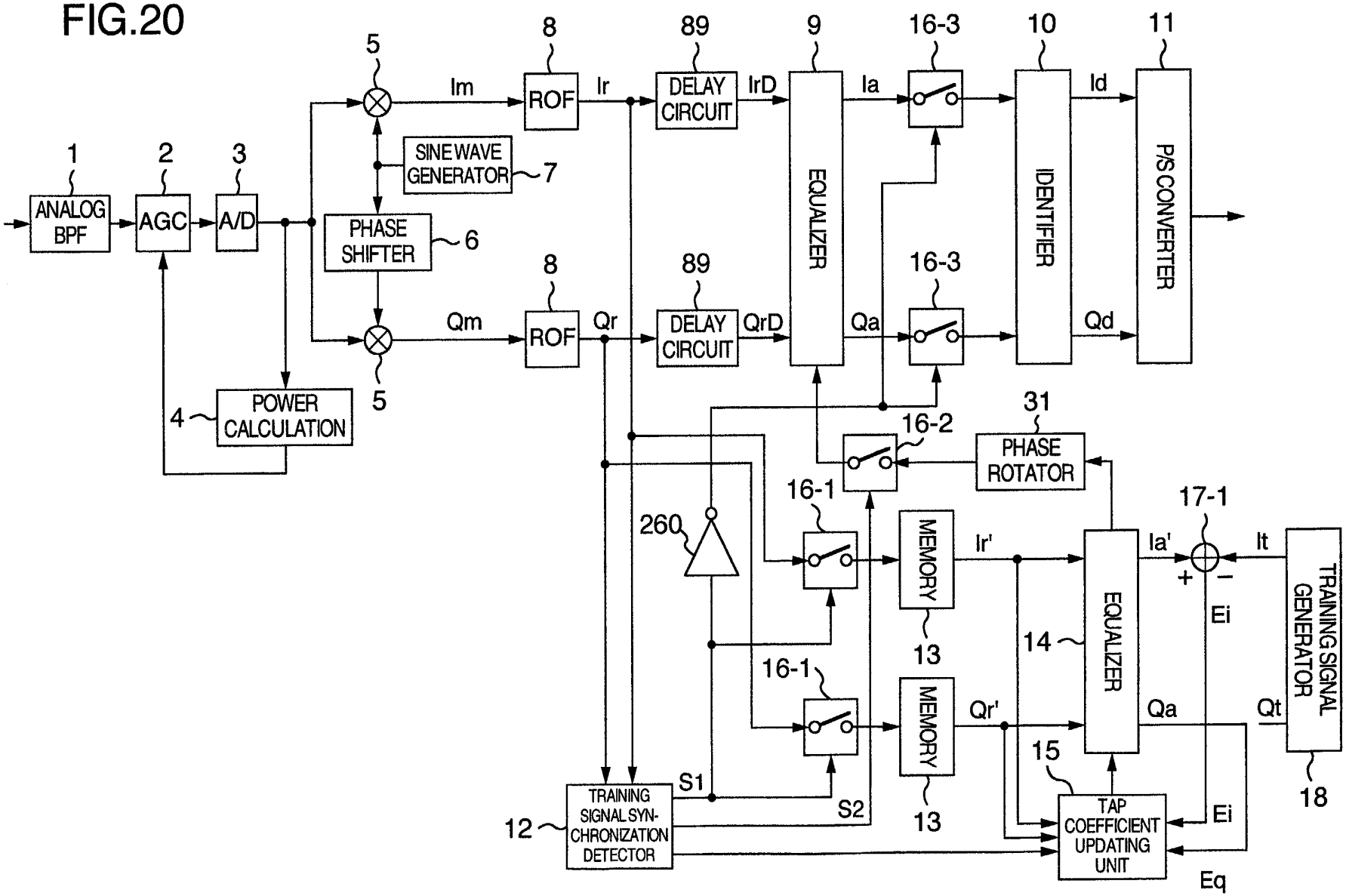
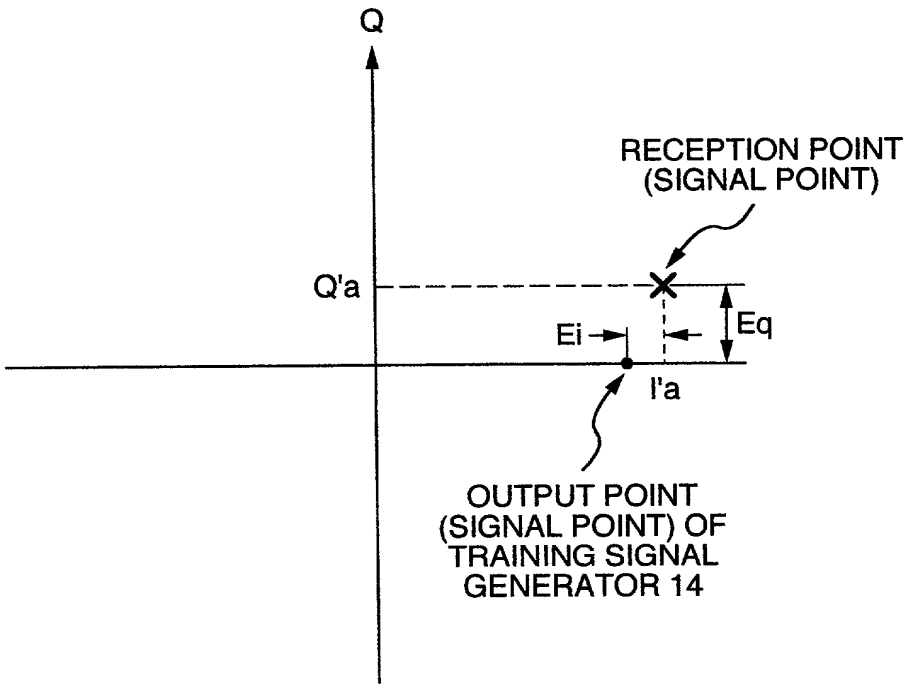

1
ANALOG BPF
2
AGC
3
A/D
4
POWER CALCULATION
5
Im
Qm
5
PHASE SHIFTER
6
SINE WAVE GENERATOR
7
8
ROF
Ir
8
ROF
Qr
89
DELAY CIRCUIT
IrD
89
DELAY CIRCUIT
QrD
9
EQUALIZER
16-3
Ia
16-3
Qa
10
IDENTIFIER
Id
Qd
11
P/S CONVERTER
31
PHASE ROTATOR
16-2
16-1
260
16-1
MEMORY
Ir'
13
MEMORY
Qr'
13
14
EQUALIZER
17-1
Ia'
+
−
Ei
It
TRAINING SIGNAL GENERATOR
18
Qa
Qt
15
TAP COEFFICIENT UPDATING UNIT
Ei
Eq
12
TRAINING SIGNAL SYN-CHRONIZATION DETECTOR
S1
S2

FIG.21


Q
RECEPTION POINT
(SIGNAL POINT)
Q'a
Ei
Eq
I'a
OUTPUT POINT
(SIGNAL POINT) OF
TRAINING SIGNAL
GENERATOR 14